Patent Claims

1. Lacquer-like mixture comprising resin and inorganic particles for applying a polymeric, corrosion-resistant, electrically conductive and electrically weldable coating which can be shaped in a low-abrasive manner to a substrate, in particular to a metallic substrate such as e.g. a steel sheet, it being possible for the substrate optionally to be precoated on at least one side of the substrate, e.g. with at least one zinc layer or/and a zinc-containing alloy layer or/and with at least one pretreatment layer, wherein the mixture comprises at least 10 wt.% of electrically conductive particles having an electrical conductivity better than that of particles of pure zinc and having a Mohs hardness of greater than 4, based on the solids contents of the mixture, and wherein these electrically conductive particles have a particle size distribution in which 3 to 22 vol.% of the electrically conductive particles, measured with a Mastersizer 2000 with a Hydro 2000S measuring head from Malvern Instruments, in a volume plot are larger than the average layer thickness of the dried and optionally also cured coating, determined on scanning electron microscopy photographs.

2. Lacquer-like mixture comprising resin and inorganic particles for applying a polymeric, corrosion-resistant, electrically conductive and electrically weldable coating which can be shaped in a low-abrasive manner to a substrate, in particular to a

metallic substrate such as e.g. a steel sheet, it being possible for the substrate optionally to be precoated on at least one side of the substrate, e.g. with at least one zinc layer or/and a zinc-containing alloy layer or/and with at least one pretreatment layer, wherein the mixture comprises at least 10 wt.% of electrically conductive particles having an electrical conductivity better than that of particles of pure zinc and having a Mohs hardness of greater than 4, based on the solids contents of the mixture, and wherein the envelope curve of the particle size distribution for these electrically conductive particles, measured with a Mastersizer 2000 with a Hydro 2000S measuring head from Malvern Instruments, in a logarithmic plot of the volume has at least two peaks and is divided into individual Gauß distribution curves, a first minimum of the individual Gauß distribution curves between the main peak and the next larger peak of these distribution curves, determined in µm, being greater by a factor of 0.9 to 1.8 than the average dry film thickness of the dried and optionally also cured coating, determined on scanning electron microscopy photographs, but not more than 22 vol.% of the particle size distribution of these electrically conductive particles being larger than the average dry film thickness.

3. Mixture according to claim 1 or 2, characterized in that the particle size distribution of the remaining inorganic particles, i.e. of all the

inorganic particles without the electrically conductive particles, measured with a Mastersizer 2000 with a Hydro 2000S measuring head from Malvern Instruments, has a higher volume content of the largest particles at the particle volume transfer value d_{98} or in the Gauß distribution curve with the largest particle volumes that at the particle volume transfer value d_{98} or in the corresponding Gauß distribution curve of the electrically conductive particles.

4. Mixture according to one of the preceding claims, characterized in that it comprises no electrically conductive particles having a particle size diameter greater than five times the value of the average dry film thickness of the dried and optionally also cured coating.

5. Mixture according to one of the preceding claims, characterized in that it comprises 20 to 80 wt.% of electrically conductive particles having an electrical conductivity better than that of particles of zinc and having a Mohs hardness of greater than 4, based on the solids contents of the mixture.

6. Mixture according to one of the preceding claims, characterized in that it additionally comprises very soft or soft particles which are capable of sliding, such as e.g. graphite, molybdenum disulfide, carbon black or/and zinc or corrosion protection pigment(s).

7. Mixture according to one of the preceding claims, characterized in that the electrically conductive particles are chosen from particles based on alloys, boride, carbide, oxide, phosphide, phosphate, silicate and silicide, preferably chosen from alloys, carbides, oxides and phosphides.

8. Mixture according to one of the preceding claims, characterized in that it additionally comprises at least one resin and optionally at least one curing agent, at least one photoinitiator, at least one additive, water or/and an organic solvent and optionally 0.5 to 15 wt.% of corrosion protection pigment(s).

9. Process for producing a polymeric, corrosion-resistant, electrically conductive and electrically weldable coating, which can be shaped in a low-abrasive manner and comprises inorganic particles, on a substrate, characterized in that a mixture according to one of claims 1 to 8 is applied to an optionally precoated substrate, optionally dried and at least partly crosslinked.

10. Process according to claim 9, characterized in that the very soft or soft particles which are capable of sliding, such as e.g. graphite, are in each case not ground or are ground with only a low intensity before addition to the mixture or in the mixture or/and in a portion of the mixture.

11. Process according to claim 9 or 10, characterized in that the electrically conductive particles are ground separately and, where appropriate, mixed with similar batches of electrically conductive particles.

12. Process according to one of claims 9 to 11, characterized in that on grinding of the electrically conductive particles, the over-sized particles are predominantly comminuted, so that a narrower particle size distribution arises.

13. Process according to one of claims 9 to 12, characterized in that the curing agent of at least one is added in an excess relative to the amount of binder of the mixture which is to be crosslinked with this.

14. Process according to one of claims 9 to 13, characterized in that the mixture applied to the substrate is dried, stoved, irradiated with free radicals or/and heated in order to form a thoroughly crosslinked, corrosion-resistant, viscoelastic coating.

15. Process according to one of claims 9 to 14, characterized in that a coating having a thickness of less than 10 µm, in particular less than 8 µm, preferably less than 6 µm and particularly preferably of less than 4 µm, measured in the dry state on scanning electron microscopy photographs, is produced.

16. Process according to one of claims 9 to 15, characterized in that the mixture is free or substantially free from organic lubricants, such as e.g. based on PTFE, silicone or oil, inorganic or/and organic acids or/and heavy metals and other cations, such as arsenic, lead, cadmium, chromium, cobalt, copper or/and nickel.

17. Process according to one of claims 9 to 16, characterized in that the substrate comprises at least one metal or/and at least one alloy and is optionally precoated, in particular comprises a strip or sheet comprising aluminium, an aluminium, iron or magnesium alloy or steel, such as e.g. automobile steels.

18. Process according to one of claims 9 to 17, characterized in that the mixture according to the invention is applied directly to a pretreatment coating.

19. Polymeric, corrosion-resistant, electrically conductive and electrically weldable coating, which can be shaped in a low-abrasive manner and comprises inorganic particles, on a thin strip, on a metallic sheet or on another type of metallic body as the substrate, characterized in that the mixture for producing the coating comprises at least 10 wt.% of electrically conductive particles having an electrical conductivity better than that of particles of pure zinc and having a Mohs

hardness of greater than 4, based on the solids contents of the mixture, and in that the substrate coated in this manner leads to an abrasion only of less than 2 g per m^2, in particular of less than 1 g per m^2 during severe shaping or severe pressing in a die of a large press.

20. Polymeric, corrosion-resistant, electrically conductive and electrically weldable coating, which can be shaped in a low-abrasive manner, comprises inorganic particles and has an average dry film thickness of at least 4 µm, on a thin metallic strip, on a metallic sheet or on another type of metallic body as the substrate, characterized in that the mixture for producing the coating comprises at least 10 wt.% of electrically conductive particles having an electrical conductivity better than that of particles of pure zinc and having a Mohs hardness of greater than 4, based on the solids contents of the mixture, and in that by resistance spot welding at least 1,000 welding points, in particular at least 1,100 welding points, can be set through two substrates coating in this manner under very difficult welding conditions such as are currently conventional in the automobile industry, without replacement or reworking of the welding electrodes and without troublesome smoke traces.

21. Polymeric, corrosion-resistant, electrically conductive and electrically weldable coating, which can be shaped in a low-abrasive manner, comprises

inorganic particles and has an average dry film thickness of at least 4 µm, on a strip or a sheet of steel 0.8 mm thick, precoated on both sides in each case with at least one layer of zinc or of a zinc-containing alloy and optionally with at least one pretreatment coating, characterized in that by resistance spot welding at least 1,000 welding points, in particular at least 1,100 welding points, can be set through two substrates coating in this manner under very difficult welding conditions such as are currently conventional in the automobile industry, without replacement or reworking of the welding electrodes and without troublesome smoke traces, the coating having been produced using a mixture which comprises at least 10 wt.% of electrically conductive particles having an electrically conductivity better than that of particles of pure zinc and having a Mohs hardness of greater than 4, based on the solids contents of the mixture.

22. Polymeric, corrosion-resistant, electrically conductive and electrically weldable coating, which can be shaped in a low-abrasive manner, comprises inorganic particles and has an average dry film thickness of at least 2 µm, on a strip or a sheet 0.8 mm thick of steel, precoated on both sides in each case with at least one layer of zinc or of a zinc-containing alloy and optionally with at least one pretreatment coating, characterized in that by resistance spot welding at least 1,800 welding points, in particular at least 2,000 welding

points, can be set through two substrates coating in this manner under very difficult welding conditions such as are currently conventional in the automobile industry, without replacement or reworking of the welding electrodes and without troublesome smoke traces, the coating having been produced using a mixture which comprises at least 10 wt.% of electrically conductive particles having an electrically conductivity better than that of particles of pure zinc and having a Mohs hardness of greater than 4, based on the solids contents of the mixture.

23. Polymeric, electrically conductive and electrically weldable coating, which comprises inorganic particles and can be shaped in a low-abrasive manner, on a substrate, which is produced using a mixture according to one of claims 1 to 8 or/and is produced using a process according to one of claims 9 to 18.

24. Steel which is sensitive to bake-hardening and has at least one coating produced according to one of claims 9 to 18 with thermal curing at temperatures not above 160 °C.

25. Use of the coating produced according to one of claims 9 to 18 as a welding primer, as a protective coating during shaping or/and joining, as corrosion protection, in particular of surfaces or in the edge, seam or/and welded seam region, as protection instead of a hollow cavity seal or/and a seam seal,

in particular for vehicle construction or aircraft construction.